WAKE FOREST UNIVERSITY	**Standard Operating Procedure (SOP)**	

PEROXIDE FORMING CHEMICALS

Effective Date:	**8/23/2013**	**Revised Date:**	**8/23/2013**

INTRODUCTION

- This SOP applied to the various chemicals that can form PEROXIDES. The peroxide forming chemicals should be tested every three to six months to ensure that PEROXIDES have not formed.
- Some organic chemicals that are prone to peroxide formation are ethers, acetals, olefins, vinyl monomers, dienes, acrylates and methacrylates, secondary alcohols, and ketones. While aldehydes, ureas, amides, and lactams readily peroxidize, the products are degraded and do not accumulate to a hazardous level.
- Some inorganic chemicals that form PEROXIDES are alkali metals, metal amides, and organometallic compounds with a metal atom bounded to carbon, and metal alkoxides.

GENERAL LAB RULES

1. No eating, drinking, smoking, handling contact lenses, or applying cosmetics in the laboratory.
2. Persons shall wear buttoned lab coat, long pants, safety glasses or goggles and appropriate gloves when working with hazardous chemicals.
3. Mouth pipetting is prohibited; mechanical pipetting devices are to be used at all times.
4. All procedures are performed carefully to minimize the creation of splashes or aerosols.
5. Wash hands
    - after handling chemicals materials,
    - after removing gloves, and
    - before leaving the laboratory.

Additional Lab Specific Rules Here

POTENTIAL HAZARDS

- Peroxides and hydroperoxides are highly reactive materials and may be extremely shock-sensitive explosives.
- Moving or unscrewing the cap from a bottle contaminated with peroxides can lead to explosion, injury and/or death.
- Many chemicals form PEROXIDES when allowed access to air over a period of time. Enough air can be introduced upon opening the container for PEROXIDES to form. Some PEROXIDES become explosive upon concentration, as happens in distillation experiments. Others cause potentially explosive polymerization reactions to occur. Organic PEROXIDES are extremely

sensitive to shock, heat, friction, light, strong oxidizers or reducers, or other forms of ignition.

- Friction, grinding, and all forms of impact shall be avoided near PEROXIDES (especially solid ones). Glass containers that have screw cap lids or glass stoppers shall not be used. Polyethylene bottles that have screw-cap lids may be used.
- Metal spatulas shall not be used to handle PEROXIDES because contamination by metals can lead to explosive decomposition. Ceramic or wooden spatulas may be used.
- Pure compounds are more likely to have peroxide formation. Volatile compounds usually present greater hazard, as the PEROXIDES become concentrated when evaporation occurs.

HEALTH HAZARDS

- Harmful if swallowed.
- Irritating to eyes and skin.
- Vapors may cause drowsiness and dizziness. Aspiration hazard if swallowed - can enter lungs and cause damage.
- May cause irritation of respiratory tract.
- Repeated exposure may cause skin dryness or cracking.
- Hygroscopic

PERSONAL PROTECTIVE EQUIPMENT

EYE PROTECTION

- Safety glasses, goggles or face shields shall be worn during operations in which PEROXIDE FORMING CHEMICALS might contact the eyes (e.g., through vapors or splashes of solution).
- Ordinary (street) prescription glasses do not provide adequate protection. Adequate safety glasses must meet the requirements of the Practice for Occupational Education Eye and Face Protection (ANSI Z87.1-1989) and must be equipped with side shields.

HAND PROTECTION

- Use disposable nitrile gloves when working with chemicals. Check chemical compatibility chart for breakthrough time when using
- Laboratory personnel should thoroughly wash hands with soap and water before and immediately upon removal of gloves.

LAB COATS, ETC.

- Button lab coats, closed toed shoes, long pants and long sleeved clothing shall be worn when handling PEROXIDE FORMING CHEMICALS. Protective clothing shall be worn to prevent any possibility of skin contact with PEROXIDE FORMING CHEMICALS.

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WORK PRACTICES

- All PEROXIDES FORMING CHEMICALS work shall be done in the laboratory fume hood.
- Peroxide hazard on concentration—do not distill or evaporate without first testing for the presence of PEROXIDES—discard or test for PEROXIDES after 6 months.
- The quantity of peroxide forming chemical used and stored shall be limited to the minimum amount required.
- Date peroxide forming chemicals when received and first opened.
- It may be dangerous to assume that a compound can be used for any procedure out of an unopened bottle. Tests have shown that 0.008 percent or more of peroxide (tested as H202) in any compound might be dangerous. According to the catalogs of several suppliers, no tetrahydrofuran presently sold is guaranteed to have less than 0.015 percent peroxide. Thus, even unopened containers might have dangerous quantities of PEROXIDES for a distillation or refluxing experiment. All containers shall be tested for PEROXIDES prior to a use that might concentrate a hazard, such as a distillation procedure.
- The sensitivity of most PEROXIDES to shock and heat can be reduced by dilution with inert solvents, such as aliphatic hydrocarbons. However, toluene is known to induce the decomposition of diacyl PEROXIDES.
- Solutions of PEROXIDES in volatile solvents shall not be used under conditions in which the solvent might be vaporized because this will increase the peroxide concentration in the solution.
- Metal spatulas shall not be used to handle PEROXIDES because contamination by metals can lead to explosive decomposition. Ceramic or wooden spatulas may be used.
- Smoking, open flames, and other sources of heat shall not be permitted near PEROXIDES.
- Friction, grinding, and all forms of impact shall be avoided near PEROXIDES (especially solid ones). Glass containers that have screw cap lids or glass stoppers shall not be used. Polyethylene bottles that have screw-cap lids may be used.
- Polymerizable monomers shall be stored with a polymerization inhibitor from which the monomer can be separated by distillation just before use. Common acrylic monomers such as acrylonitrile, acrylic acid, ethyl acrylate, and methyl methacrylate can form PEROXIDES, they have not been reported to develop hazardous levels in normal use and storage. The hazard from PEROXIDES in these compounds is substantially greater when they are stored in the liquid phase.
- Although air will not enter a gas cylinder in which gases are stored under pressure, these gases are sometimes transferred from the original cylinder to another in the laboratory, and it is

difficult to be sure that there is no residual air in the receiving cylinder. An inhibitor shall be put into any such secondary cylinder before one of these gases is transferred into it; the supplier can suggest inhibitors to be used. The hazard posed by these gases is much greater if there is a liquid phase in such a secondary container, and even ignited gases that have been put into a secondary container under conditions that create a liquid phase shall be discarded within 12 months.

- Carry out distillation behind shields.
- Do not leave ethers for long periods of time (about six months), in a half-filled container or in the light.

SPECIAL HANDLING PROCEDURES AND STORAGE REQUIREMENTS

- Do not store with incompatible material
- PEROXIDE FORMING CHEMICALS may not be stored for more than one year. After one year these materials must be disposed.
- Store flammable PEROXIDE FORMING CHEMICALS in a flammable storage cabinet.
- Store peroxide forming chemicals away from heat and light.
- To minimize the rate of decomposition, PEROXIDES shall be stored at the lowest possible temperature consistent with their solubility or freezing point. Liquids or solutions of PEROXIDES shall not be stored at or lower than the temperatures at which the PEROXIDES freeze or precipitate because PEROXIDES in these forms are extremely sensitive to shock and heat.

Additional Lab Specific Special Handling/Storage Procedures

WASTE DISPOSAL

- PEROXIDE FORMING CHEMICALS may not be stored for more than one year. After one year these materials must be disposed.
- Excess PEROXIDE FORMING CHEMICALS and all waste material containing PEROXIDE FORMING CHEMICALS must be placed in a container labeled with the following **"HAZARDOUS WASTE PEROXIDE FORMING CHEMICALS"** , AND INCLUDE THE FULL CHEMICAL NAME.
- Contact EHS at x3427 for hazardous waste removal.

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EMERGENCY PROCEDURES

Emergency Numbers:

Fire and Medical Emergencies	x5911 (911 on cell phone)
Environmental Health and Safety	x3427
Hillcrest Urgent Care (employees)	336-760-8999
Student Health (students only)	x5218
Poison Control	800-222-1222

FIRST AID

1. If inhaled: If breathed in, move person into fresh air. If not breathing, give artificial respiration. Call x5911 for medical assistance.
2. In case of skin contact: Take off contaminated clothing and shoes immediately. Wash off in safety shower for at least 15 minutes and call x5911 for medical assistance.
3. In case of eye contact: Rinse thoroughly at eyewash for at least 15 minutes and call x5911 for medical assistance.
4. If swallowed: Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Call x5911 for medical assistance.
5. Call x5911 and describe the extent of injuries.
6. Report all accidental exposures to EHS and Human Resources (employees) or Student Health (students).
7. Complete an online injury/illness report if there is an over-exposure to the chemical or if there is an accident involving the chemical.

SPILL AND ACCIDENT PROCEDURES

- If the chemical spilled is considered a carcinogen, reproductive toxin or highly toxic chemical, contact x3427 and evacuate area immediately, regardless of spill amount.
- If you are unsure if peroxides have formed, DO NOT MOVE the container. Evacuate the area and contact x3427.

For all other spills use the chart below for spill reporting and response:

SPILL QUANTITY	PROPER SPILL RESPONSE
Spill less than 500 mL	**Contact Environmental Health and Safety (x3427) and clean up spill using spill kit.**
Spill greater than 500 mL	**Do not attempt to clean up spill. Leave the area and immediately report to WFU Police (x5911) and EHS (x3427).**